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## FARMERS' COPING STRATEGIES TO A CHANGED COFFEE MARKET AFTER ECONOMIC LIBERALIZATION: THE CASE OF MBINGA DISTRICT IN TANZANIA

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**ABSTRACT** The Mbinga District of Tanzania is a major coffee production area occupied by the Matengo, who cultivate food and cash crops. In 1986, the Tanzanian government introduced Structural Adjustment Programmes, and in 1993, liberalized the coffee market. As a result, subsidies to agricultural inputs were abandoned, and the cooperative union that had been responsible for coffee production and marketing in Mbinga collapsed. At the same time, improvements to growing and processing technologies and the entry of new coffee-producing countries caused overproduction in the global coffee market; thus, the price of coffee decreased to an unprecedented level. With the excessive supply, prices remain in stagnation, but the costs of agricultural inputs continue to rise. Mbinga farmers have pushed for various policy changes regarding coffee production and the natural and social environment while making the best use of the lessons learned from their initial experiences in the new market economy. They have structurally transformed the rural economy, whereby income is generated by distributing the coffee revenue that used to be invested in business. They also have developed a risk-management strategy. In the 10 years since economic liberalization, the farmers abandoned the state system, became economically self-reliant, and modified the structure of the rural economy.

**Key Words:** Cassava; Diversification; MBICU; Pig; Valley bottom.

### INTRODUCTION

In 1967, the Tanzanian government adopted the Arusha Declaration, which advocated a policy of African socialism and self-reliance, called *ujamaa*. The concept was to build a nation based on equality by controlling the economy and providing free social services to the people (Nagu, 2001). To this end, the government implemented villagization in 1969. However, the program was beset by various difficulties, including poor planning, the oil crisis of 1974, and the droughts of 1974 and 1979. Furthermore, the balance-of-payments crises in the 1980s exacerbated the ailing rural economy (Coulson, 1982; Maghimbi, 1992). In response, the government abandoned the *ujamaa* policy and began implementing liberal economic reforms.

Major socioeconomic changes began in Tanzania in 1981. The government adopted several adjustment measures to redress the economic crisis. In 1986, Structural Adjustment Programmes (SAPs) were introduced under the supervision of the International Monetary Fund (IMF) and World Bank. The programs

emphasized the centrality of market forces and limited the state's role in the management of the economy and the provision of free social services. A main objective was to allow market forces determine prices, rather than the government (Mwakalobo, 2000; Cooksey, 2003). In the agricultural sector, domestic markets were opened to the private sector and some subsidies for agricultural inputs were abolished. Liberalization of the domestic coffee market began in 1993 and entailed the opening of the coffee market to private buyers who were allowed to compete with farmer cooperatives (Temu, 1999; Ponte, 2002a). Consequently, the liberalized markets replaced the previous coffee trade monopolized by cooperative unions.

More recently, improvements to growing and processing technologies and the entry of new coffee-producing countries and regions caused an overproduction in the global market; thus, the price of coffee decreased to an unprecedented level. At the same time, the cost of inputs increased, which, along with higher incidences of disease and aging coffee trees, led to a decline in the importance of coffee production to the local economy (Ellis, 2000). The coffee industry, which had supported the rural economy of Mbinga for many years, had been transformed. Growers who cultivated coffee for trade struggled to manage their fields. Many growers (including those in Kilimanjaro, the biggest coffee-producing area) shifted from coffee production to other activities to generate income (Larson, 2001). Bryceson (1996) dubbed this shift "de-agrarianization," a process whereby the rural population becomes less agrarian in nature or farmers increasingly become dependent on sources of income other than farming. In Africa, this shift has been considered a strategy for coping with the crisis accelerated by the SAPs (Bryceson & Jamal, 1997).

However, a shift away from agriculture is not always feasible, especially in peripheral rural areas with poorly developed local economies and other infrastructures such as transportation systems. The Mbinga District, a major coffee-producing area, is one such peripheral area of Tanzania (Fig. 1). The Matengo people living in Mbinga have therefore developed a farming system that combines coffee cultivation as a cash crop with an intensive, indigenous cultivation system called *ngolo* to grow maize and beans as staple foods (Itani, 1998). They continue to depend on this farming system, despite the decline in the coffee economy.

We investigated the influence of economic liberalization on the rural economy, with a focus on coffee cultivation in the Mbinga District and how local farmers have adapted.

## RESEARCH SITES AND METHODS

The Mbinga District is located in the southern part of Tanzania. Its coffee-growing areas can be divided roughly into three agro-ecological zones (Fig. 2). The western mountain region of the district, where the Matengo people originated, has a cool climate suitable for growing mild arabica coffee, although a

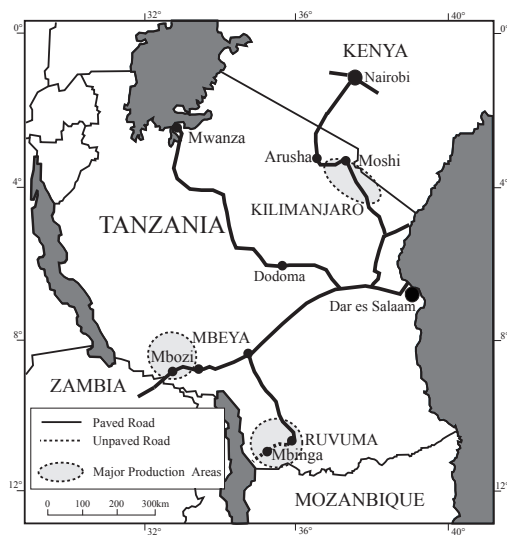


Fig. 1. Map of Tanzania

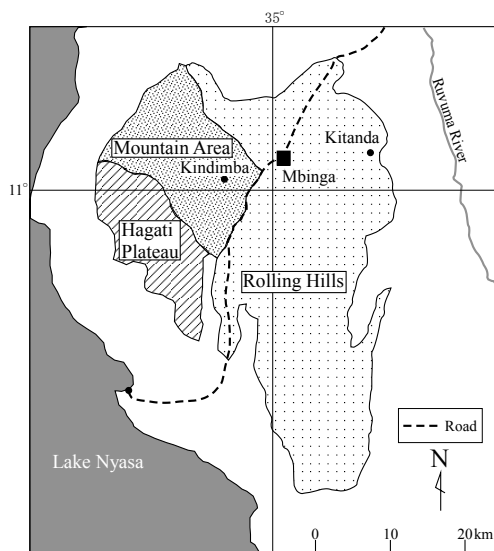


Fig. 2. Location of research sites in the Mbinga District

high population density and shortage of land has limited the expansion of coffee cultivation. Expansion has required the conversion of fields previously used for food crops (Nindi, 2004). In the Hagati Plateau, located in the southwestern part of the district, the soils are too sandy for *ngolo* cultivation, which arranges a lot of pits in field to prevent soil erosion; therefore, cassava is the main staple food crop. The rolling hills of the eastern region are covered with dry, open woodlands called *miombo*. Coffee and *ngolo* cultivation have supported the live-

lihoods of the Matengo as the pillars of their economy and food production, respectively. The growing population in the mountain areas since the 1950s has resulted in land shortages (Hill, 2001), and generations of young people who did not inherit land migrated to the *miombo* foothills. There they created a livelihood also based on *ngolo* and coffee cultivation.

Our research was conducted from October to December 2004 in the villages of Kindimba and Kitanda, which were selected as typical villages in the western mountain and eastern hilly regions, respectively. Households were categorized by family size and the age of the head of the household based on the results of a preliminary survey, and 50 households were selected from each category. Most respondents were men because most people involved in the production and marketing of coffee in Matengo society are male (Hill, 2001). All respondents were over 30 years old because we focused on the socioeconomic changes in the 10 years since economic liberalization began in 1993.

## MAJOR CULTIVATION SYSTEMS AND LIVELIHOODS

The farming system in the Matengo Highlands is based on *ngolo* and coffee cultivation (Pike, 1938; Basehert, 1972; Itani, 1998). The Matengo own more than two *ngolo* fields and they rotate maize and beans (Itani, 1998). Coffee is cultivated close to the homestead because it is labor-intensive and requires attention throughout the year (Schmied, 1989). The Matengo live in communal settings and collaborate in several socioeconomic activities, including the cultivation of interfluvial areas they call *ntambo*, which are areas of land located between mountain streams (Kato, 2001). As a geographical unit, *ntambo* refers to an area of land on the mountainside that is circumscribed within river tributaries (JICA, 1998); as a socioecological unit, it shapes the unique pattern of land use and socioeconomic organization among the Matengo. They use the woodlands for construction materials and raising livestock on hilltops where the soil is shallow, tend coffee fields near their homesteads and *ngolo* fields on the slopes, and use marshes on the valley bottom for cultivation during the dry season. They can produce most of their foodstuffs and cash income within *ntambo* (JICA, 1998).

## THE IMPACTS OF ECONOMIC LIBERALIZATION

### I. Dropping Coffee Prices in the World Market

The price of mild arabica coffee in the world market has tended to decrease since the 1980s, and it reached its lowest level in 1992 (ICO, 2004). This was caused by several factors, including competition from the production of robusta coffee, improvements in processing technologies, and the overproduction of

coffee in general because of the introduction of new varieties and production areas and improvements in cultivation technologies worldwide. For example, Vietnam is a new production area of organic robusta coffee, and the country has increased its share of arabica coffee market in the last 10 years (Baffes, 2003).

The production of mild arabica coffee is unreliable because it is sensitive to pests, disease, and changes in weather. Moreover, its price fluctuates according to worldwide production. For example, serious frost damage in Brazil in 1994 dramatically reduced the worldwide coffee production and caused a sharp increase in the price of coffee. At the same year, the coffee market in Tanzania was liberalized, and Mbinga coffee growers misinterpreted the rise in price as the result of the collapse of the Mbinga Cooperative Union (MBICU). As Brazil's coffee production recovered, the price of coffee again dropped. Although the price increased again in 1998 due to an El Niño event, it did not affect the revenue of Tanzanian coffee growers because their production decreased.

## II. Collapse of the Mbinga Cooperative Union (MBICU)

In 1986, the Tanzanian government implemented Structural Adjustment Programmes (SAPs), under the supervision of the World Bank and the International Monetary Fund (IMF). In 1989, the MBICU was formed, separating from the Ruvuma Region Cooperative Union. It catered to the coffee market (Ringo, 1995). However, MBICU did not have the capital and its management depended on loans from commercial banks. Even so, MBICU supplied as many agrochemicals and fertilizers as the growers needed. In addition, it assisted coffee production by delivering these agricultural inputs to villages in a timely manner, recovering the costs of purchase and transport by deducting a fee from the growers' revenues (Ringo, 1995). That is, the growers paid for agricultural inputs indirectly and thus sustained coffee production without worrying about production costs (Temu, 1999; Ponte, 2002a). Therefore, growers could invest all of their net profit from coffee into other businesses and/or assets.

In 1993, however, the government liberalized the domestic coffee market by licensing private coffee buyers (PCBs) to compete on equal footing with cooperative unions. MBICU was not credit-worthy because of accumulated bank debt, and the loans were suspended (Banturaki, 2000). MBICU could not compete with the PCBs, and went bankrupt. As a result, the coffee growers were forced to meet production costs themselves. At the same time, the costs of agricultural inputs were increasing and coffee prices were declining due to overproduction. Eventually, growers could not afford to use agricultural inputs as recommended, leading to more pest infestations and disease. Moreover, many of the coffee plants had become too old to produce enough good-quality fruit. All of these factors negatively affected the livelihoods of the Mbinga coffee growers, and coffee production in the Mbinga District rapidly declined.

### III. Supply of Agricultural Inputs

Prior to liberalization, the agricultural inputs subsidized by the government were affordable to most growers. After liberalizing the economy, the government was forced to reduce the subsidies, and the prices of agricultural inputs were determined by market forces (Temu, 1999; Ponte, 2002a; Cooksey, 2003). In addition, the retail cost of chemical fertilizers sold by privately owned shops in Mbinga town increased after 1996 (Fig. 3). These changes directly affected coffee production and the incomes of growers.

The district's agricultural office provides the following guidelines for the application of chemical fertilizers: 1 acre of land should be treated with a maximum of 100 kg in December, 150 kg in mid-February, and 100 kg at the end of March, for a total of up to 350 kg/year. If a grower applies calcium ammonium nitrate as recommended, the annual production cost for fertilizer only in 2003–2004 would have been 112,000 Tanzanian Shillings (TSH), or about US \$107 (Fig. 3). Although the costs of fungicides and/or pesticides have stabilized in recent years, the annual cost of using Dursban, a brand of chlorpyrifos pesticide that is applied frequently in Mbinga, was TSH 32,000/acre at the recommended standard of application (0.5 L/acre, four times). In addition, the income from coffee production in 2003 was estimated at TSH 150,000–180,000/acre (based on a yield of 500 kg/acre; about 1 kg of parchment harvest from each of 500–550 plants/acre). Again, the calculations of agricultural inputs are based on the recommended application standard. Based on the lowest price of coffee in 2003 (TSH 300–360/kg), the expenses for agricultural inputs accounted for 90–95% of gross income.

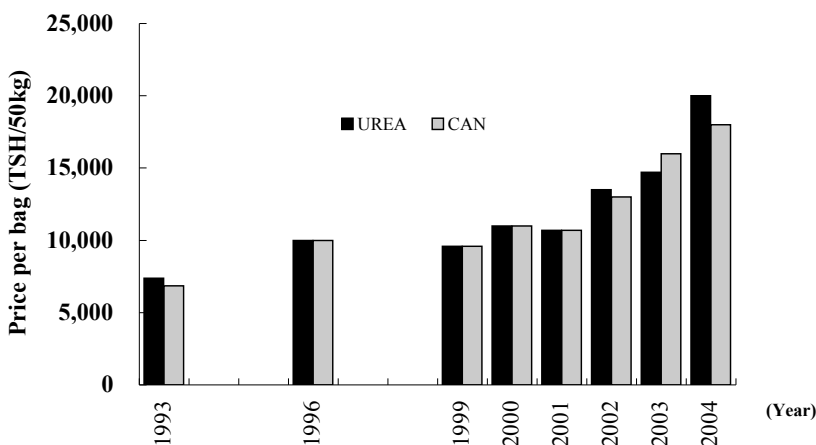


Fig. 3. Changes in the costs of agricultural inputs in Mbinga

\*Data source: Mbinga District Agriculture and Livestock Office.

MBICU had distributed the agricultural inputs to growers on a loan basis, deducting the operating costs after selling the coffee (Ringo, 1995). However, this advantage disappeared with the collapse of MBICU. The PCBs were not interested in supplying agricultural inputs to growers (JICA, 1998), and the coffee producers were forced to purchase and transport the inputs themselves. During the era of MBICU, Mbinga coffee growers had spent their revenue quickly by investing in and/or purchasing assets; they were not accustomed to managing their money or maintaining a savings for small necessities.

Population pressure in the mountain areas in Mbinga also reduced the available land for fallow, driving the division of farm fields into small hamlets (Nindi, 2004). This, in turn, coupled with an increasing demand for food, necessitated the use of chemical fertilizers to ensure enough food production for subsistence. Although income from coffee had been used to purchase fertilizers for food crops during the MBICU era (Kato, 2001), the growers could hardly afford to distribute the fertilizers for food crop cultivation without the previous state subsidies.

Thus, the liberalization of the coffee market broke the relationship between coffee inputs and output, and resulted in the limited use of inputs among the growers. Many could not earn sufficient income to purchase and transport the inputs at the time application was required (Temu, 1999; Ponte, 2002b). As a result, coffee production declined. To address this problem, the Tanzanian government formulated a National Coffee Inputs Voucher Scheme (NCIVS), which required PCBs to purchase input vouchers equivalent to TSH 50 per kg of parchment harvest from the NCIVS, and to pay the coffee growers with cash. The vouchers were aimed to help growers purchase inputs without wasting production costs.

However, all of the stores selling these inputs were located in the town of Mbinga, far from the villages of most coffee growers, who thus had to spend money just to reach the town and exchange the vouchers. Consequently, for small farmers, the input voucher system was another burden, and they preferred to be paid in cash. This led to the emergence of a secondhand market for vouchers, where middlemen purchased vouchers for low prices in the villages to resell them directly to the agricultural input shops (Ponte, 2002b). Thus, the failure to use input vouchers as intended further increased the problems of coffee production in Mbinga.

Further compounding the issue, diseases and insects can seriously damage coffee yield and quality, and thus it is important to apply agrochemicals. The most important of these in Mbinga are pesticides used during bud formation in September and fruit-setting in January. The most frequently used agrochemicals are fungicides for coffee berry disease such as blue and red copper applied in September, December, and May. Coffee growers who could not purchase these inputs by either cash or voucher had to borrow money to do so. However, limited sources of credit in the villages with which to finance coffee production and other social requirements forced the villagers to borrow from moneylenders, who required them to repay their debts at the beginning of the harvest sea-



son. For example, in 1999, a farmer who borrowed TSH 10,000 in January was obliged to repay after harvesting in August. Payments were made in bags of parchment coffee roughly equivalent to TSH 30,000. If one failed to repay the debt, for example, due to poor yields or sickness of a family member, a part of the coffee field was seized as collateral. This loan system was called *magoma*. Although the district authorities prohibited the practice of *magoma* in 2000 because it pressured the livelihoods of the coffee growers, it continues secretly among the villagers to maintain the coffee trees and production due to the limited rural financial loan system.

MBICU and the local government had attempted to maintain a high quality of coffee through several activities using extension workers. After liberalization, however, the quality of coffee deteriorated for several reasons. The shortage of inputs lowered not only the productivity, but also the quality, and the coffee growers lost incentive to fairly groom the trees and process berry into parchment coffee, which are necessary steps for producing high-quality coffee. Furthermore, PCBs were more interested in quantity than quality and thus started purchasing coffee as early as possible, even before beans were fully ripe. In addition, the price of Mbinga coffee (part of the Columbia Mild Arabica Coffee Group) drops sharply each December when Colombian coffee harvests enter the market; therefore, PCBs try to sell their stocks before then. Likewise, the illegal moneylenders practicing *magoma* pressure the debtors to return the debts earlier. The customary method of removing pulp by fermentation to produce parchment is time-consuming. In response to the pressure from moneylenders, some growers with debts used boiling as a quicker way to process coffee, although the quality of the parchment was markedly lower. As a result, the quality of coffee from Mbinga deteriorated and fetched even lower prices on the market.

## COPING STRATEGIES AFTER ECONOMIC LIBERALIZATION

### I. Changes in Coffee Cultivation

Research conducted in areas of Tanzania that produce mild arabica coffee, such as Arusha, Kilimanjaro, and the Rungwe District in Mbeya, reported that coffee growers tended to reduce coffee cultivation because of decreasing prices of coffee, rising costs of agricultural inputs, and a lack of credit (Mwakalobo, 2000; Larson, 2001; Ellis, 2000). In particular, Kilimanjaro, which has strong socioeconomic and political links to urban resources and a well-developed transportation system, has more alternatives for obtaining alternative income. The coffee growers in the region could intensify their focus on other income-generating activities such as the cultivation of bananas and other cash crops or the maintenance of dairy cattle (Ellis, 2000).

However, the response of farmers in the Mbinga District to the recession of the coffee economy was different from those in areas with such alternatives.

Table 1 shows the number of respondents from the villages of Kindimba and Kitanda who expanded or reduced their coffee fields after the collapse of the MBICU. Despite the prolonged recession in coffee price, half of the respondents expanded their fields. Table 2 lists the reasons for expansion or reduction. Most growers who expanded their fields anticipated a price recovery, and some were forced to convert their fields from maize to coffee due to decreasing soil fertility (Table 3); they explained that coffee seedlings grow on infertile conditions when a small amount of organic manure is applied, whereas maize requires chemical fertilizers. The main reason stated for field reduction was the death of trees due to disease and/or insect attack coupled with the inability to replant trees due to a lack of cash or labor. Very few growers decreased their coffee fields intentionally, likely because coffee production, even under the current economic situation, is still considered valuable in rural areas such as Mbinga, which have very few opportunities for crop trading or alternative sources of income.

**Table 1.** Change in number of coffee growers who expanded or reduced the coffee fields after collapse of MBICU in Kindimba and Kitanda Villages (n=62)

	Respondent	Coffee Grower	expansion	reduction	no change
No. of household	62	60	30	15	15
%*	-	100	50	25	25

\*Percentage to coffee growers

**Table 2.** Reasons for expansion or reduction of coffee fields (n=45)

Reasons for change	Number of growers
<b>Reasons for expansion</b>	(n=30)
Anticipation of prices increase	23
Infertile land for maize	8
Others	7
<b>Reasons for reduction</b>	(n=15)
Death of trees due to lack of inputs	13
Lost land	1
Sold to other villager	1
Burned by bush fire	1
Abandoned due to low coffee returns	1

Respondents gave multiple responses

**Table 3.** Previous land used for expanded coffee garden (n=38)

Previous land	No. of fields
Food crops	16
Fallow	7
Coffee fields	6
No answer	8

Another reason for Matengo coffee growers to increase or maintain the size of their coffee fields is related to credit. Farmers can use fields as collateral for obtaining loans. To qualify, moneylenders inspect the borrower's coffee fields to assess their credit worthiness. Therefore, ownership of a coffee field can also help one obtain cash in an emergency, a valuable prospect for the Matengo, who do not customarily save money. Owning a coffee field is also considered a symbol of manhood in their society. In general, when a son gets married or becomes an adult, he inherits a coffee field from his father. Thus, if a father does not have enough coffee fields to divide among his sons, he is obliged to prepare new coffee fields, mostly in unexploited lands.

On the other hand, the livelihood of the Matengo is based on their indigenous farming system that mainly combines *ngolo* food cultivation and coffee production, which have been developed correlatively. Previously, coffee served as the foundation of the household economy and food production; the income from coffee provided the chemical fertilizers for *ngolo* fields with insufficient fallow lands.

Thus, for the Matengo, coffee is not only an economic base but helps ensure food security and is a part of the culture. For these reasons, coffee production cannot easily be abandoned, even though its economic value is declining.

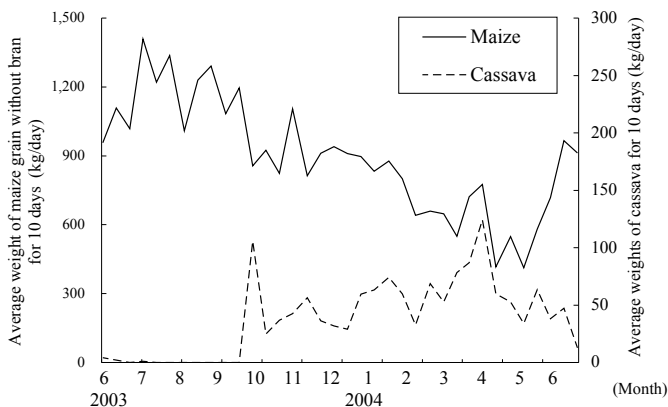
## II. Changes in the Farming System

A shortage of fallow lands for food cultivation in mountain areas has made it necessary to use chemical fertilizers to sustain their subsistence. Before economic liberalization, the Matengo farmers used revenue from coffee to purchase the fertilizers used in maize fields (Kato, 2001). However, the drop in coffee prices and the reduction of subsidies for agricultural inputs made it difficult for farmers to purchase and use chemical fertilizers for any crops. Therefore, they used other strategies to sustain the production of both coffee and food staples.

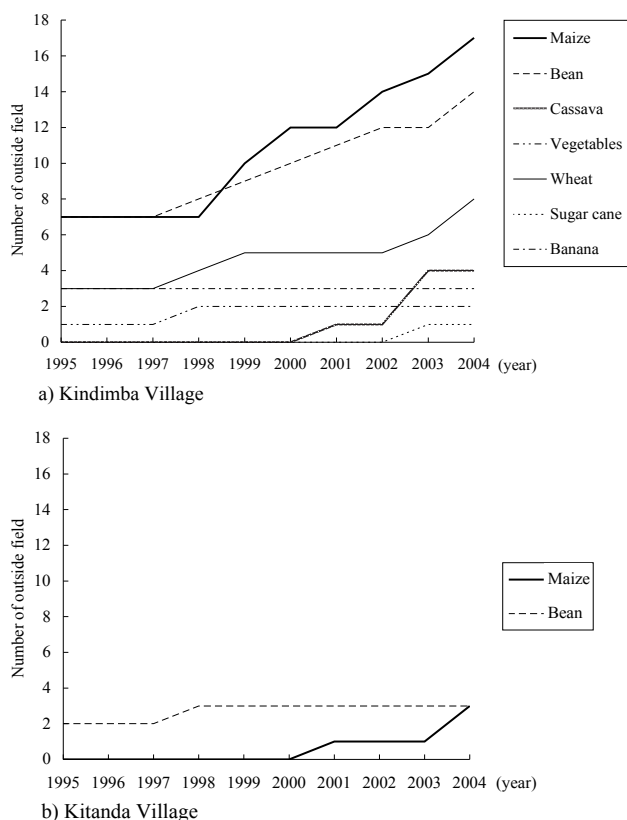
In 1997–1998, Tanzania received heavy rains due to an El Niño event, and crop production was remarkably damaged, even in the *ngolo* fields. The local government enacted by-laws to encourage the cultivation of cassava, which can produce high yields without chemical fertilizers. Many of the Matengo, except for farmers living in Hagati Plateau, had very little previous experience with cassava cultivation, although they understood the availability of cassava. Adopting its cultivation helped them through a severe famine in the following year, and since then, cassava cultivation has been incorporated into the farming system of the Matengo. Maize and cassava are ground by a milling machine to cook a porridge called *ugali*. Figure 4 indicates the seasonal changes in the amounts of maize and cassava brought to the hydro mill machine in 2003–2004. The data were obtained from receipts saved by the village. The machine was installed in Kindimba in 2001 jointly by the Center for Sustainable Rural Development, Sokoine University of Agriculture, Japan International Cooperation Agency (JICA), Kindimba Village, the Mbinga District Council, and an NGO called Caritas. The hydro mill machine is used by many villagers in Kindimba

and neighboring villages because its operational costs are lower than diesel-operated milling machines. A large amount of maize was consumed throughout the year, but maize consumption peaked after the harvest season (July and August) and declined gradually until the next rainy season (Fig. 4). From September onward, the consumption of cassava increased sharply due to a decrease in the stored maize and continued until the next maize harvest. Thus, cassava has recently played an important role for subsistence as an emergent food crop, as well as a source of calories, which ensures food security, particularly in March when the Matengo cultivate the *ngolo* fields.

The responses of the Matengo to the introduction of cassava cultivation differ according to the region. In Kitanda, which is located in the rolling and abundant woodlands, cassava fields were established in uncultivated lands covered with bracken (*Pteridium* spp.), whereas in Kindimba, which is located in mountain areas that lack sufficient arable land, the farmers were obliged to cultivate cassava in infertile maize fields. However, because their staple food was always maize, they had to compensate for the shortage of maize fields with other areas. As a result, many of the farmers who lost maize fields in mountain areas acquired alternative fields in remote areas outside the sub-village or village (Fig. 5). As mentioned earlier, the Matengo have an indigenous land use system, as well as a socioeconomic unit, called *ntambo*, which has supported their livelihoods. Nindi (2004) pointed out that after economic liberalization, the expansion of remote fields was the most significant change related to land use in the mountain areas, and this tendency caused environmental degradation in the remote areas because the farmers could not manage the fields well throughout the year. The farming system examined within *ntambo* is changing to meet the demands for food. Thus, various changes have influenced the livelihood of the Matengo and their indigenous farming system.



**Fig. 4.** Seasonal changes in the amounts of maize and cassava brought to the hydro mill machine in Kindimba (mountainous area) in 2003–2004



**Fig. 5.** Change in the number of fields located outside villages after the collapse of the MBICU

### III. Reduction in the Use of Agricultural Inputs

Mild arabica coffee is vulnerable to insects, disease, and soil infertility, and the application of pesticides is inevitable for coffee production in Mbinga. For example, antestia bugs (*Antestiopsis* sp.) and coffee berry borers (*Hypothenemus* sp.) seriously damage coffee yields during flower-bud formation and fruit-set. Therefore, to maintain coffee trees and sustain production, coffee grower must properly apply pesticides prior to fungicides. Figure 5 shows the annual schedule for both coffee and *ngolo* cultivation, and the relationships between them. According to recommendations from the Tanzania Coffee Research Institute (TaCRI) and District Agriculture and Livestock Development Office, coffee growers should apply fertilizers at least three times a year (in mid-December, mid-February, and late March), and apply pesticides four times a year (in September, when flower buds are formed after harvest; January, when flowers and fruits are set; and late March and May, to prevent attacks by stem borers). In addition, fungicides should be applied twice (in late March and

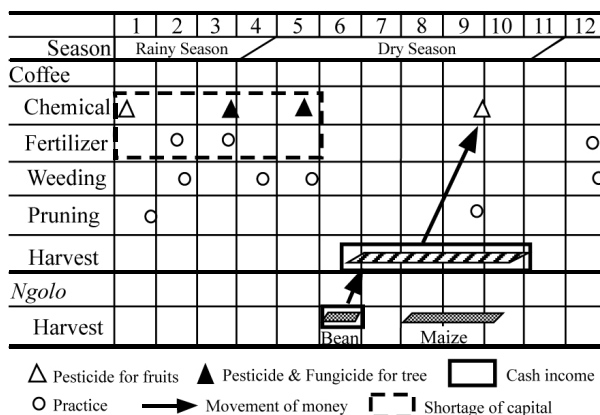


Fig. 6. Annual schedule of coffee and *ngolo* cultivation

Table 4. Utilization of agricultural inputs before collapse of MBICU and in 2003/04 seasons

Inputs	Season	User Households		Frequency of application
		(n=62)	%*	
Chemicals	Before collapse of MBICU	51	82	3.0
	2003/04	49	79	1.8
Fertilizer	Before collapse of MBICU	51	82	2.3
	2003/04	20	32	1.4

\* % of respondents

May) along with the pesticides (Fig. 6). Coffee growers believe that high yields cannot be obtained without applying these agricultural inputs.

As explained above, MBICU distributed agricultural inputs to growers two or three times per year, following the application schedule. After its collapse, however, PCBs did not distribute the inputs. Therefore, to maintain coffee production, growers had to purchase and transport agricultural inputs themselves. However, the availability of inputs was also complicated by the increase in the cost of chemical fertilizers (Fig. 3).

Table 4 shows how often agricultural inputs were used before and after the collapse of the MBICU. Many coffee growers continued to use agrochemicals after the collapse, although at a lower frequency. They also used the chemicals selectively at critical times such as applying pesticides during flower bud formation and fruit-set. However, many growers abandoned fertilizers, arguing that they were too expensive to purchase and the input vouchers were insufficient, and that coffee trees would still survive and produce yields without fertilizer (but not without agrochemicals). Thus, the selective use of agricultural inputs is one strategy currently used by the Matengo to sustain coffee trees. Similarly, to reduce production costs, an indigenous pesticide made from the wild plant *Tephrosia vogelii* is often applied to coffee trees to prevent insect damage.

As a substitute for chemical fertilizers, animal manure was used. Table 5 shows the changes in the use of animal manure before the collapse of the

**Table 5.** Utilization of animal manure before collapse of MBICU and in 2004/05 seasons

	Before collapse of MBICU	%*	2004/05	%*
No of Respondent	64		64	
Manure user	14	23	37	60
Source				
Pig	7	11	32	52
Goat	0	0	14	23
Cattle	0	0	7	11
Chicken	0	0	3	5
Applied to				
Coffee	14	23	35	56
Maize	1	2	3	5
Vegetable	0	0	4	6
Tobacco	1	2	0	0

\* % of respondents

MBICU and in the 2004–2005 rainy season. The percentage of households using animal manure increased from 23% before the collapse to 60% in 2004–2005. Many farmers began storing and applying pig and goat manure. In areas with little high-quality grassland, the holding capacity of ruminants (e.g., cattle, sheep, goats) is low, especially in the mountain areas. The animals are customarily tethered in the grassland and most of the dung is lost during grazing. In contrast, pigs can be fed easily indoors with maize bran, and manure can be collected without loss. For the Matengo, the majority of whom are Christians, pigs are valuable livestock as a source of food, manure, and income.

#### IV. Use of Hired Labor

In the rolling hills of the eastern region, the harvest of coffee berries begins in June. Because not all coffee berries ripen at the same time, it is recommended to pick the fully matured (reddest) berries only. Therefore, harvesting takes place over a period of 3–4 months. Although households can use family labor, those with larger fields or small households usually employ hired labor to help in the harvest. It should be noted that during the harvest period, most coffee growers have already exhausted their income from the previous season and thus must depend on other sources of income to pay for labor. Figure 7 shows how the farmers in Mbinga raised money to cover labor costs. The open triangle in the figure indicates the application of pesticides to flowers and fruits, and the solid triangle denotes pesticide and fungicide application to trees. Some coffee growers used the income from selling beans to pay for labor. However, limited experience in financial management prohibited most coffee growers from purchasing agricultural inputs from January to June.

#### V. Diversification of Income Sources

The MBICU had paid the farmers the net income from coffee in three installments, and growers typically spent all of their net income to purchase

**Table 6.** Distribution of coffee income to other activities (n=69)

	Households	%
Investment		
Purchasing livestock	21	43
Purchasing land	10	20
Savings	1	2
Expenditures (Durable)		
House Construction	11	22
Furniture	1	2
Expenditures (Daily necessities)		
Education	11	22
Daily needs	24	49
Medical expenses	5	10
Purchasing food	15	31
Emergency	2	4
Ceremonies	1	2
Agricultural running costs		
Agricultural Inputs	10	20
Waged labour	2	4
Others		
Local brew	1	2

assets and daily necessities. However, after the collapse of the MBICU, the PCBs that took its place paid cash and only once, i.e., at the time of the transaction; the purchase of pesticides applied in September soon after harvest and the payments of debts to moneylenders exhausted this money. As a result, to obtain agricultural inputs for the next season, growers had to take out loans with high interest rates.

In response to these circumstances, the coffee growers reformed their money management. Table 6 indicates how respondents allotted coffee income to other activities in 2004. The income accrued from coffee still played an important role not only for purchasing daily necessities and durable goods such as construction materials for houses, but also for investing in other income-generating activities. For example, 43% of respondents invested the income in livestock, mainly pigs, which are easily marketable and suitable to the farming system; 20% of respondents purchased lands to expand the cultivation of cash crops. The income obtained from these various activities was often used to purchase agricultural inputs for coffee cultivation.

Table 7 shows the main sources of income in the villages of Kindimba and Kitanda. Villagers currently compensate for the shortage of revenue from coffee by engaging in various income-generating activities. Although before liberalization, coffee cultivation had supported all other activities, including food production, the relationship has recently reversed as the coffee industry declined and alternative income-generating activities became more diverse.

The main source of income in Kindimba is local brewing, whereas that in Kitanda is the sale of crops and livestock. The difference between the two villages can be explained by the availability of arable land; there is high population pressure and no extra arable land available in Kindimba and thus most



**Table 7.** Sources of income used to compensate slumping of coffee revenue (2004)

	Kindimba Household (n=31)		Kitanda Household (n=31)	
		%		%
Crops selling	13	42	27	87
Food crops	5	16	26	84
Vegetables	11	35	16	52
Local brewing	23	74	9	29
Livestock selling	14	45	18	58
Waged labour	12	39	3	10
Handicraft/Carpenter	10	32	9	29
Store/Broker	10	32	3	10
Fish selling	0	0	2	6

**Table 8.** Households that expanded crop fields following collapse of MBICU

	Ngolo (%)	Ridge (%)	Valley bottom (%)
Kindimba (n=31)			
Maize	10	29	3
Beans	32	3	3
Cassava	39	3	0
Vegetables	3	0	39
Sugarcane	0	0	48
Kitanda (n=31)			
Maize	32	10	6
Beans	29	6	16
Cassava	42	16	0
Vegetables	0	0	45
Sugarcane	0	0	0

women brew local beer, whereas there is available land in Kitanda and newly settled households in that village can afford to purchase more land (Nindi, 2004). By comparing the trends in the two villages, it can be concluded that land availability is a main factor determining the strategies that are employed by the Matengo to compensate for the shortage of coffee revenue.

Thus, commercialization of the food crops has resulted in the expansion of crop fields. Table 8 shows the proportions of households that expanded their crop fields following the collapse of the MBICU. Many households in both villages expanded bean cultivation because the income from beans harvested in June can be used to pay for labor for picking coffee berries after July (Fig. 7) and/or to fund a traditional harvest festival called *chiyoda* held in July and August. Other remarkable tendencies are increases in cassava cultivation and farming of the valley bottom, neither of which was actively done in the past, according to elders in these villages. In 1998, when heavy rains seriously damaged crop production in Tanzania, the local government in Mbinga encouraged the cultivation of cassava and the valley bottom to increase food production; both have become incorporated into the farming system. Most of the available areas in the valley bottom have been cleared and used for the cultivation of

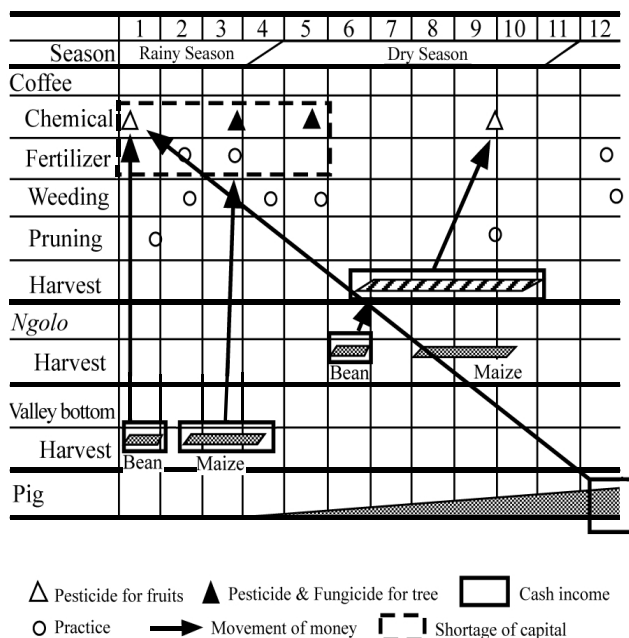


Fig. 7. Annual schedule of the Matengo farming system and the relationship between them

beans, maize, sugarcane, and vegetables as cash crops and food materials. The income obtained from valley bottom cultivation can support the purchase of agrochemicals for coffee cultivation.

Although the expansion of cassava cultivation could stably support the food supply, it would result in fewer maize fields. The bran removed during the maize grinding process is the most important feed for pigs, but the supply of bran has decreased with increasing cassava consumption. Furthermore, the amount of maize bran available fluctuates seasonally with maize consumption, which decreases from October to the next harvest from the valley bottom in March (Fig. 3). The shortage of feed influences the number of pigs that can be kept and the length of time they can be maintained.

Previously, the Matengo usually kept pigs for about 2 years, selling them only in an emergency or for ceremonies. After economic liberalization, however, the maintenance period shortened to 8 months due to the shortage of maize bran and the increasing need to have cash, in particular to purchase agrochemicals. Although a pig typically gave birth to 5–10 piglets at once, the bran shortage made it difficult to keep all of them at the same time. Therefore, owners often sold many or all of the piglets to their neighbors. In many cases, however, because farmers had no capital with which to purchase piglets, they would receive them on loan, to be paid back after harvesting beans or coffee. Through this distribution system of piglets, everyone could easily obtain a pig at any time and then secure a small amount of income to sustain coffee cultivation. For example, a farmer who acquired a piglet in April could keep it for

8 months, until January, and sell it for cash to purchase agrochemicals. Furthermore, after selling a pig, the same farmer could sell maize bran to other pig owners during the period of bran shortage from January to April. Thus, the system functions as risk management, as well as mutual aid.

## CONCLUSION

In 1993, the Tanzanian government liberalized the coffee market under the Structural Adjustment Programmes of the IMF and World Bank. Around the same time, improvements to growing and processing technologies and the entry of new coffee-producing areas and countries caused overproduction in the global market, thereby driving down the price of coffee to an unprecedented level. As a result, the coffee industry, which had supported rural economies for many years, now faces serious economic issues that threaten the subsistence of the local people. Coffee growers in Mbinga had to adopt several strategies to deal with the socioeconomic issues that arose from the collapse of the MBICU, including the drop in net income from coffee, the end of an easily accessible supply of agricultural inputs, and the difficulty of managing money throughout the year. The farmers adopted four major strategies to sustain their livelihood, namely, the expansion of coffee fields, diversification of income sources, distribution of coffee income to other activities, and selective use of agricultural inputs. Coffee growers expanded their coffee fields by clearing unused lands or shifting from maize cultivation to coffee, which reduced maize production and led to farmers, especially in the mountain region, to search for other lands in remote areas to resume maize cultivation. Moreover, the decline in coffee income resulted in the inability to purchase chemical fertilizers for maize and coffee production. In addition, maize cultivation in the mountain areas decreased the soil fertility, causing a shortage of this staple food. These shortages forced farmers to expand cassava cultivation for food security and to intensify their use of the valley bottoms. Furthermore, they diversified their sources of income by cultivating other cash crops, keeping livestock, and engaging in non-agricultural activities. This enabled them to earn income throughout the year, and thus obtain the money necessary to purchase agricultural inputs at the proper times of the season. At the same time, however, the maize shortage made it more difficult to keep pigs. In response, owners kept pigs for a shorter period of time, and a piglet distribution system was created. The collapse of the MBICU forced farmers to purchase and transport agricultural inputs themselves. The declining net income from coffee led to most farmers minimizing their use of such inputs and selecting the most effective uses for each input. In Mbinga, pesticides had priority over fungicides and fertilizers, and the shortage of fertilizers was supplemented by animal manures, mostly from pigs.

In the mid-19th century, the Matengo created an intensive cultivation system called *ngolo* while forced to live only in the upper areas of mountains by the Ngoni people. Following the colonial period, the Matengo developed an inten-

sive farming system that combined *ngolo* and coffee cultivation, which was introduced from Kilimanjaro in the early 20th century. Thus, the socioeconomic constraints accelerated the intensification of land use and the farming system. After market liberalization, some households expanded their fields, even as the coffee industry declined, to maintain their lifestyle and their farming system. However, most households could not afford to expand and have found ways to reduce the costs of production, use land more intensively, and revitalize indigenous technologies, including cultivation systems.

In summary, economic degradation led to the diversification of income sources, yet this was not always related to technological innovation or introduction. Even in rural areas, new technologies are introduced regularly, and people attempt to evaluate their feasibility. A technology that proves useful to current circumstances may be internalized into the society and improved upon to adapt to changing socioeconomic conditions. Such a technology may eventually be considered indigenous. The spread of pig keeping and valley bottom cultivation in Mbinga was caused by the modification of indigenous technologies in the process of a declining economy. The economic constraints led to a commercialization of the indigenous technologies and a more intensive use of the natural resources to maintain their livelihoods and diversify their incomes.

The farmers gradually adapted to the liberalized economy and today are no longer passive and dependent recipients of state-endorsed programs. In 10 years, the farmers abandoned the system supported by the state, became economically self-reliant, and modified the structure of their rural economy.

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